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(54) Title: A COMPUTER METHOD AND COMPUTER SYSTEM BASED ON A SIMULATED ENVIRONMENT USING PROCEDURAL ANIMATION IN A SIMULATED CITY

(57) Abstract

An electronic game uses electronic map data and an environment grower to create a rich environment. An avatar maintenance system further enhances the game environment. The game is then sufficiently complex to be used by thousands of users.

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A computer method and computer system based on a simulated environment using procedural
animation in a simulated city.

BACKGROUND OF THE INVENTION

The invention relates to a computer method based on a simulated
environment using procedural animation in a simulated city, and in particular based on
software to be used in networks.

5   Many current electronic games are limited in the number of users that
they can accommodate, typically no more than a handful. This limitation is partly because
the hardware and software have not been designed for more users. However, multiuser
hardware and software is well known and readily available for game designers to use. More
importantly, limitation on the number of users of games is due to the complexity of creating

10   a virtual environment which contains enough data to accommodate large numbers of users.
Ideally, each user needs to have his or her own game environment which interfaces to the
game environments of other users. If the number of users becomes very large, such as
10,000, the amount of data required to create a unique game environment becomes
impossibly expensive to generate.

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SUMMARY OF THE INVENTION

Accordingly, amongst other things, it is an object of the invention is to
create an electronic environment which has enough data to accommodate very large numbers
of users at once, while at the same time doing so with existing, and moderately priced

20   facilities. Now according to one of its aspects, the invention provides a computer method
comprising
-          inputting electronic map data into a computer system, and
-          in the system, growing a simulated environment from the electronic map data.
Electronic maps have been made available for various purposes, and the secondary growing

25   of an environment requires relatively little computing power.

The invention also relates to a computer system for implementing the
method. Various further advantageous aspects of the invention are recited in dependent
Claims.

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BRIEF DESCRIPTION OF THE DRAWING

The invention will now be described by way of non-limitative example with reference to the following drawings.

Fig. 1 shows a network on which the game according to the invention can

5   run.

Fig. 2A shows a system for running the environment of the invention.

Fig. 2B shows an alternative embodiment of the system.

Fig. 2C shows another alternative embodiment of the system.

Fig. 3 shows still another alternative embodiment of the system.

10   Fig. 4 shows a screen of a video game using the environment of the

invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In order to accommodate a very large number of users, an electronic

15   environment must run on a network, as illustrated in Fig. 1. A server 101, with a high speed

network connection 110 will run the game according to the invention. The server 101 can be,

for instance, a Sun Sparc20, that is locally connected to a database with electronic map data

120, and which via the network connects to many remote users 102-107. The connection 110

should allow for high rates of data transfer to and from the server, for instance a T1 line

20   communicating large quantities of data with the network 102. The individual users need only

have ordinary phone lines 100. Alternatively, the server 101 can maintain a large number of

ports over ordinary phone lines to individual users who call in. The server 110 can run

game software or any other software which requires a rich geographical environment. The

network 102 may be any suitable large network, such as the Internet.

25   Users, each situated at their own stations 103-107, will interface with the server

101 via the network 102. User interface stations can be standard IBM compatible personal

computers (PC), each provided with a respective local data base drawn as a cylinder.

Fig. 2A shows one embodiment of a system for generating an

environment in accordance with the invention. While it is virtually impossible to create

30   enough fictitious data to maintain 10,000 game environments, in fact the real world is an

extremely complex environment which maintains billions of people. Electronic maps 201

have already digitized enough real world data to provide places for many digital users to

play. Particularly useful maps for this purpose are available on the market from Navigation

Technologies, 740 East Arques Ave, Sunnyvale CA 94086-3833. These maps have a great

deal of detail for the purposes of automobile navigation, but also include points of interest, such as hotels, restaurants, museums, gas stations, parking lots, and tourist attractions.

However, the maps alone do not create a rich environment. They are two dimensional maps. In order to enrich the user environment, the maps are preferably software

5   enhanced by growing a rich environment using an environment grower 202. An example of such an environment grower is set forth in Lindstrom et al., "Level-of-Detail Management for Real-time Rendering of Phototextured Terrain", GVU Technical Report GIT-GVU-95-06, Georgia Institute of Technology, and Koller et al, "Virtual GIS; A Real-Time 3d Geographic Information System", GVU Technical Report GIT-GVU-95-14, Georgia Institute

10   of Technology. The output of the environment grower is a rich environment 203, such as a simulated city, suitable for use by multiple users. Such an environment growing module is typically implemented using software code though it could also be hard wired. The environment so grown may comprise various terrain-defined features, such as hills, deserts, woods, grassland and waterways. In addition various human constructions can be

15   implemented, such as houses, office buildings, roads, bridges, runways and tunnels. In this context, the term "city" should be understood to mean a human-inhabited area, without restriction by standard architectural or sociological concepts.

The environment 203 is input to a game supervision system 204 which includes a game rule module 206. The game rule module interacts with a memory 205,

20   which stores user choices, as well as with the environment 203 to create the game. The game rule module can be any standard network game.

In general, user choices will be expressed in terms of simple commands, such as -go to the treasure- or -stab my neighbour-. Other movement or action command can be input directly by a joystick or other gesture sensor. These commands should have a

25   format which is as condensed as possible in order to reduce input output times. Preferably therefore changes in representation of the avatars representing the various users should be generated largely automatically. An avatar maintenance module 207 continually updates the avatar appearances so that the game will be dynamic rather than static. The avatar maintenance module not only responds to user choices 205, but also keeps the avatars

30   moving in an entertaining way even when no changes in user choices are entered. In this way, if one user goes to the kitchen to get a snack, any neighbours in the game environment need not detect or be bored by the user's absence or non-activity. Alternatively, the avatar maintenance module may be used to create the impression that more users are playing than are actually signed on. Real users can be substituted for artificial avatars at any time during

the game. Eventually, the enriched game environment and avatar configuration are stored in instantaneous database 208.

A suitable avatar maintenance module is described in Perlin, "Real Time Responsive Animation with Personality", IEEE Trans. on Visualization and Computer
5   Graphics, Vol. 1, No. 1, March 1995, pp. 5-15 and Perlin, "Live Paint: Painting with Procedural Multiscale Textures", Computer Graphics Proceedings, Annual Conference Series, 1995, pp 153-160. Such an avatar maintenance module is typically implemented in software code, but could also be hardwired.

A game rule module server might create multiple games in the same
10   environment. Users might wander from game to game in that environment.

An alternative embodiment of a game system in accordance with the invention is shown at Figure 2B, wherein like elements carry the same numerals as in Figure 2A. This embodiment seeks to minimize data transfer by distributing game processing to local work stations such as stations 102-107 in Figure 1. In this alternative embodiment, an
15   environment segmenter 209 sends only a representations of a geographical segment 210 of the game to any one user. The user's local station 213 includes a local version of the game rule module 216. The local game rule module 216 receives the game segment representation 210 from the network and sends new user choices 211 back to the network. The local game module 216 interacts with the user via a display 214 and an input device 215, such as a
20   keyboard and/or a pointer device. The local game module maintains a complete local game segment 212 which is updated by the user's choices, the game segment representation, and a local avatar maintenance module 217. Putting the avatar maintenance module 217 in the local station and maintaining a complete local game segment 212 reduces the amount of data transfer over the network.

25   User choices can trigger the game supervision system to choose a new part of the electronic map data and 201 and trigger the environment grower 202 to grow some more environment.

A third alternative embodiment is shown in Fig. 2C. Here electronic map data is fed to an environment grower 202 to create enriched map data 203. The avatar
30   maintenance module 207 adds avatars to the map data and stores the combination in memory 230. The memory then stores a representation of avatars interacting with the enhanced electronic map data. The game rule module 206 then uses the environment stored at 230. If a new piece of map is desired, the game rule module 206 must ask the environment grower for it. If a change of avatars is to be triggered by user choices, the game rule module 206 must

communicate this to the avatar maintenance module 207. The network is symbolized by item 229.

Those of ordinary skill in the art may devise any number of enhancements or alternative ways of combining the elements described above.

5   Fig. 3 another embodiment of the invention. PC 103 that is provided with display output 305, that may operate in conjunction with other output types, such as a speech channel, renders a current point of view of a virtual world using game supervision module 310 and local stored environment 311. The local stored environment is generated according to the method of Fig. 2C. The local stored environment 311 can be generated locally, or

10   broadcast to the PC at the start of the game, or broadcast to the PC on a periodic basis. The local game supervision module 310, taking input from a local input device 304, generates local avatar data. The term "avatar" is a term of art which was first used in N. Stephenson, Snowcrash (Bantam Books 1993). Other terms of art for this concept include the word "sprite". The avatar represents the PC user's persona in the virtual world. A current state of

15   the avatar is transmitted via phone line 302 or other equivalent back channel to the server 301. The server 301 takes all of the signals from phone line 302 and other similar sources of information. Game supervision module 320 combines all of the avatars and calculates their interactions, using the stored environment 322. Game supervision module 320 then creates a broadcast form for all of the avatars, which is preferably digital. The broadcast form may be

20   compressed by compression module 307 before being broadcast, e.g. via satellite or cable, over transmission channel 303 to PC 103 and other users. A local cable provider 308 may convert the broadcast signal to an analog form for the PC 103, if necessary.

The combined broadcast signal is in the form of states for other avatars in the region used by the local PC user. Compression 307 and decompression 330 can be used

25   to make communication more efficient.

The local input control 304 can be any standard input device such as a keyboard, joy stick, trackball, or infrared remote control. Local input control can also be via a virtual reality input system such as a tactile resistance device or VR data gloves. The display on the PC can be adapted for use with 3D glasses 305.

30   Similarly, in the environment of Fig. 1, the PC's can maintain the rich environment and receive packet type messages from the internet, analogously with mobile radio type applications. The PC's of all the figures can be equipped with the various input and output devices described for Fig. 3. The server of Fig. 1 can also transmit data in a sequential concatenated form any combined form whether digital or analog, compressed or

uncompressed.

Fig. 4 shows a sample screen for a simplified version of a game using an
environment according to the invention. As shown, the display features a "my" car seen on
dashboard and through the wind shield. The environment comprises a starry sky, a road
5   rendered in perspective, and various high-rise buildings. On the avatar level, the display
features a second car dead front, and a humanoid figure approaching from the right.

CLAIMS:

1.   A computer method comprising

 -          inputting electronic map data into a computer system, and

 -          in the system, growing a simulated environment from the electronic map data.

2.   A computer method as claimed in Claim 1, furthermore using avatar
maintenance code for maintaining one or more avatars in the environment.

3.   A computer method as claimed in Claims 1 or 2, furthermore being
arranged for maintaining an electronic game that interacts with the environment.

4.   A computer system comprising:

 -          input means for inputting electronic map data into the system;

 -          database means for receiving and storing said map data;

 -          growing means for growing a simulated environment from the electronic map
             data.

5.   A computer system as claimed in Claim 4, and comprising processor
means for maintaining an electronic game that interacts with the environment stored in the
memory.

6.   A computer system as claimed in Claim 4 or 5 wherein the processor is a
game server and further comprising means for communicating data relating to the simulated
environment to a remote processor.

7.   The computer system as claimed in Claim 4, 5 or 6 wherein the data is a
portion of the simulated environment.

8.   A computer system as claimed in Claims 4 to 7 wherein the portion
comprises avatar data.

9.   A computer system of Claim 6 wherein the means for communicating
comprises one of a network, the internet, broadcast cable lines, and phone lines.

10.   A computer system as claimed in any of Claims 4 to 9 wherein the
processor is a remote processor and further comprising means for communicating data
relating to the environment with a central server.

11.   A computer system of Claim 10 wherein the means for communicating
comprises one of a network connection, the internet, and a phone line.

12.   A computer system as claimed in any of Claims 4 to 11, and comprising central processor means for maintaining an environment with avatars in that environment;

-          means for communicating portions of the environment to distributed processor means,

5 -   and wherein the portions are the avatars.

13.   A computer system as claimed in Claim 12 wherein the central processor is a game server.

14.   A computer system as claimed in Claim 12 wherein the communicating means is also for receiving local data from the distributed processor means.
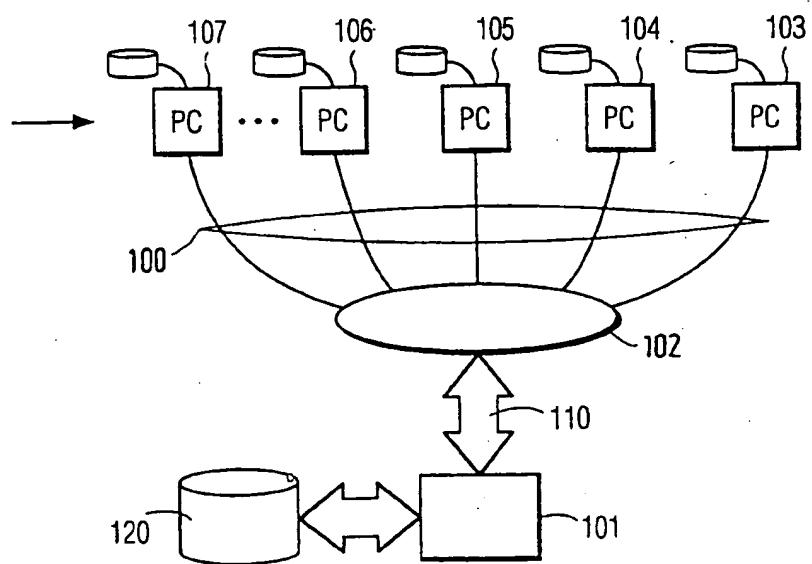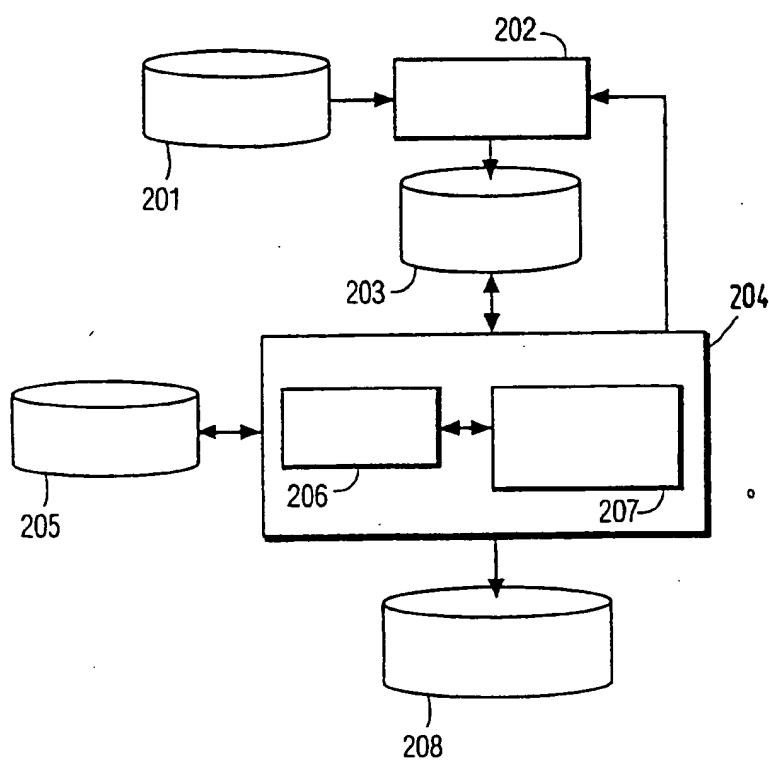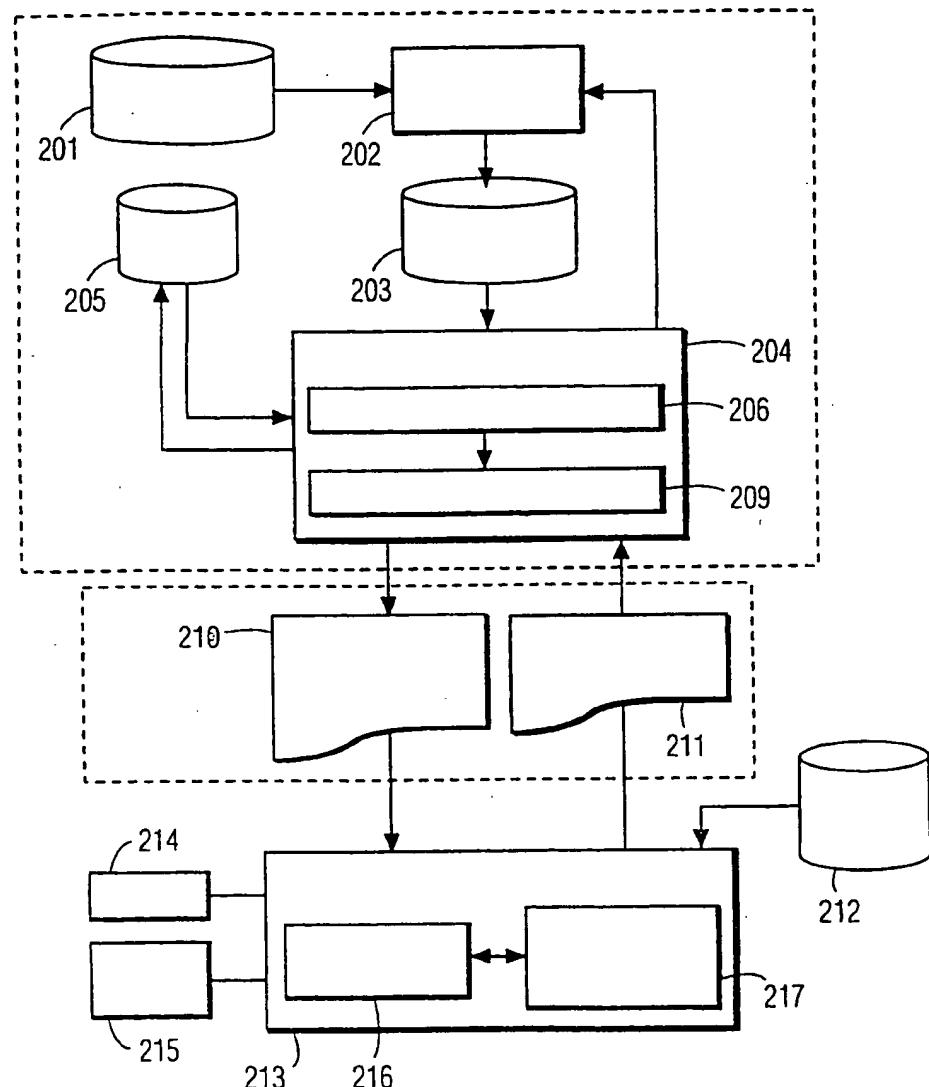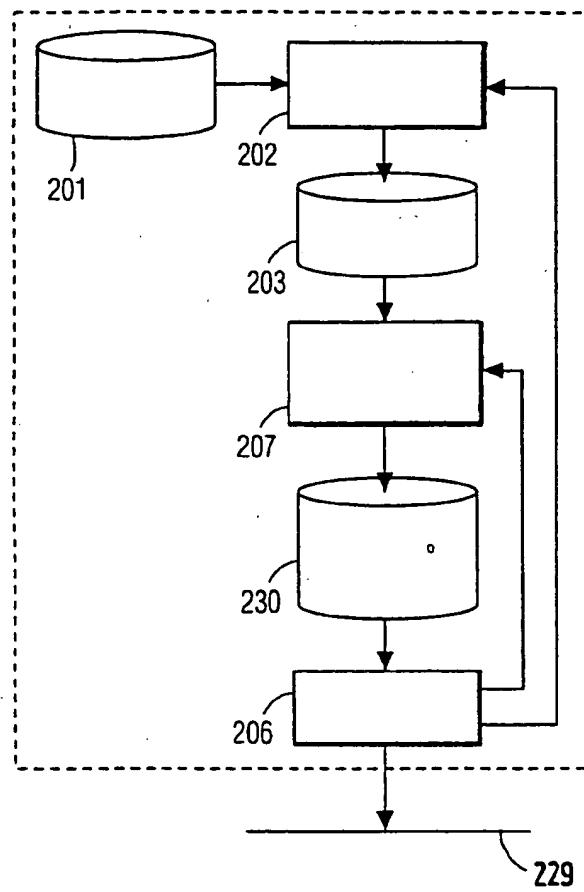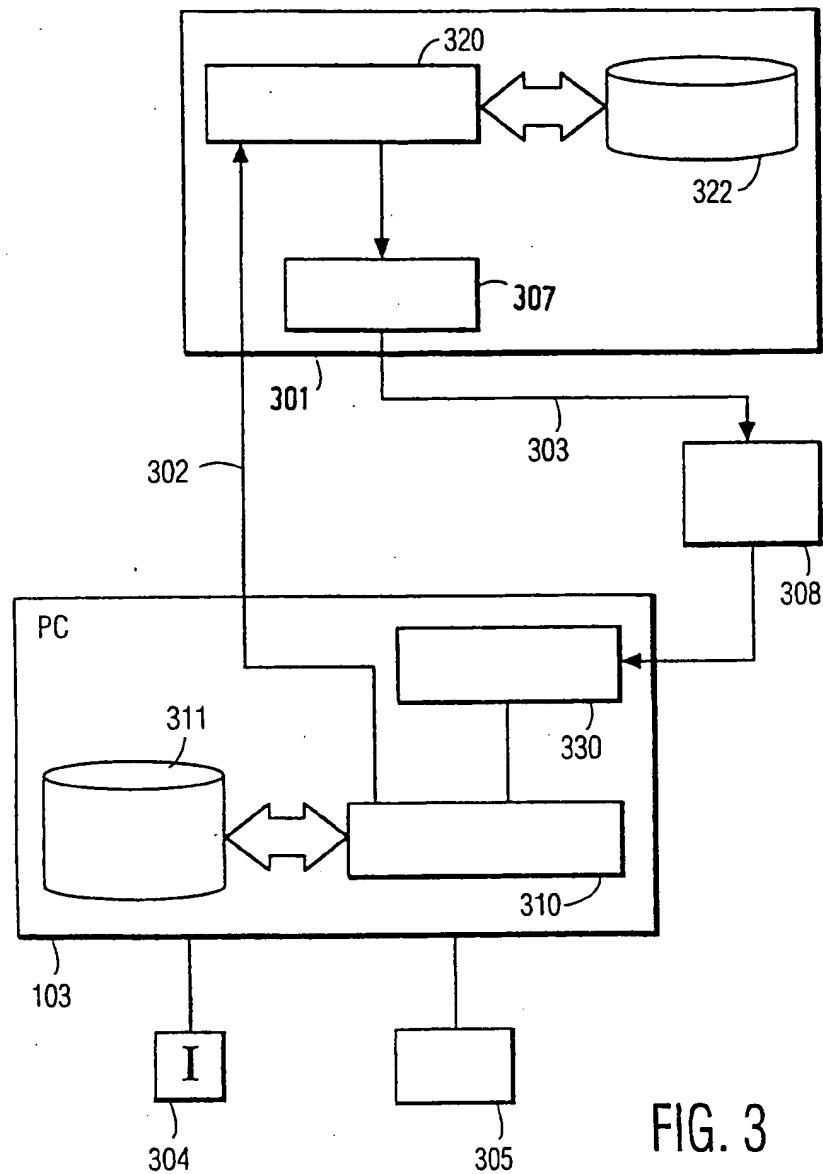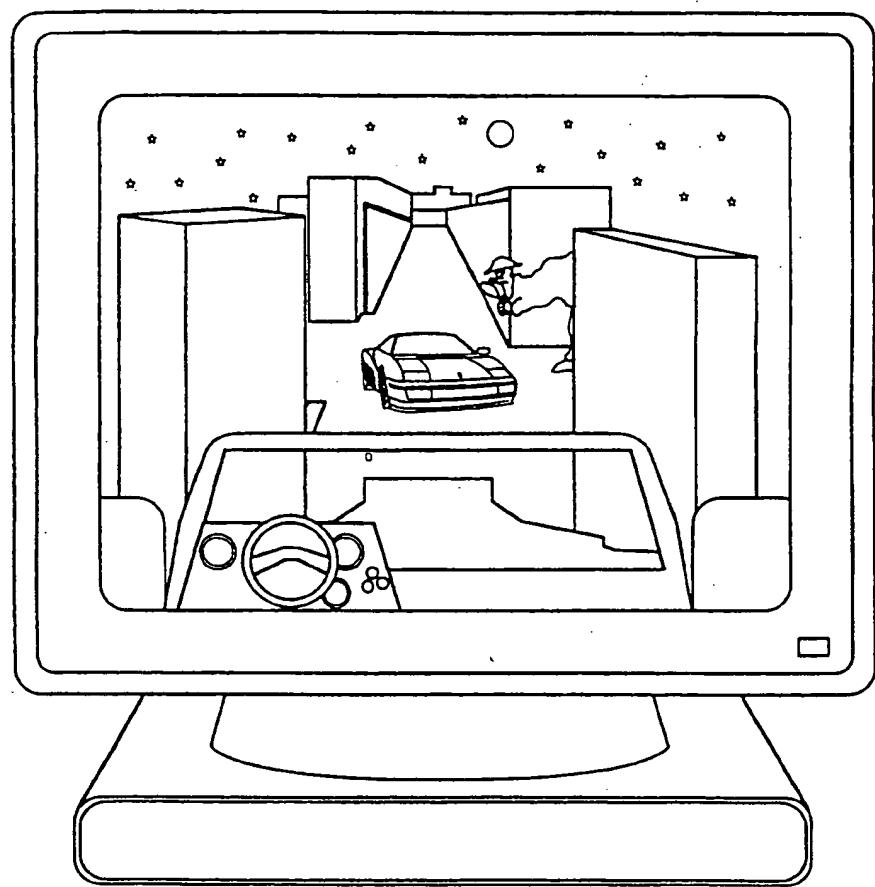
FIG. 1

FIG. 2A

FIG. 2B

FIG. 2C

FIG. 3

FIG. 4

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An electronic game uses electronic map data and an environment grower to create a rich environment. An avatar maintenance system further enhances the game environment. The game is then sufficiently complex to be used by thousands of users.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB 96/01398

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: G06T 17/00, G06F 19/00 // G0F 161:00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: G06T, G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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P,Y	EP 0696018 A2 (NIPPON TELEGRAPH AND TELEPHONE CORPORATION), 7 February 1996 (07.02.96), page 1, line 28 - line 56 --	2,6,8-14
A	EP 0507548 A2 (GENERAL ELECTRIC COMPANY), 7 October 1992 (07.10.92), column 1, line 47 - line 58; column 2, line 1 - line 12 --	1,4

[X] Further documents are listed in the continuation of Box C.   [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
27 June 1997	3 0 -06- 1997
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB 96/01398

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